REMARKS

Claims 1-10 are pending in this application. Claims 1 and 8 are amended, and new claims 11 and 12 are added by this response. Support for the amendments is as follows: Claims 1 and 8 (Specification, p. 15, l. 13-19; p. 15, l. 23-24; p. 17, l. 3-17), Claim 11 (Specification, p. 13, l. 12-18); and Claim 12 (Specification, p. 19, l. 11-21; Examples 1-3). No new matter is added.

Claims 1, 7, 8, and 10 are rejected under U.S.C. 103(a) as being unpatentable over Le Costaouec (U.S. Publication No. 2003/0219646 A1) in view of Ilno et al. (U.S. Publication No. 2002/0086198 A1). (Office Action p. 2)

Le Costaouec discloses a bipolar plate for use in a fuel cell or battery which is in the form of a composite structure having a plastic matrix containing carbon fibers which are electrically conductive and are orientated in a manner to optimize electrical conductivity. (Le Costaouec, Abstract) La Costaouec only teaches carbon fibers that are oriented parallel to the thickness of the plate. (La Costaouec, paragraphs 28 and 30)

> Orientation of the conductive carbon fibers in the direction parallel to the thickness of the plate promotes improved electrical and thermal conductivity across the bipolar plate and "as-molded" in fine surface details eliminates post forming machining steps and provides two important features in optimizing performance and cost of a fuel cell.

(La Costaouec, paragraph 28)

La Costaouec teaches away from the claimed invention by disclosing the carbon fiber orientation in a direction parallel to the thickness of the plate. In contrast to La Costaouec, in the claimed invention the conductive powder is held within the **entangled thermoplastic resin fibers in a fiber web.** (Claim 1, Specification, p. 17, l. 3-17) The thermoplastic resin fibers are not oriented in any specific direction.

The specification of the present invention states that there are three methods for producing the nonwoven fabric and that the second method is preferred. "This production method has an excellent nonwoven fabric productivity and does not require the use of surfactants

and thickeners that are originally not needed in fuel cell bipolar plates. Moreover, the conductive powder used as the raw material is more securely held in the nonwoven fabric than when needlepunching is used." (emphasis added) (Specification, p. 18, l. 21-25) This is also the method used to produce the nonwoven fabric of Examples 1, 2, and 3, of the present invention.

The Office Acton states that "Le Costaouec does not specifically teach the diameter of the fibers." (Office Action p. 3) Ilno discloses an electrically conducting curable resin composition wherein, depending on the use of the end product, various types of **carbon fibers** and thicknesses are provided. (Ilno, paragraph 30) Further, Ilno discloses that carbon short fiber can include middle carbon fiber, vapor grown carbon fiber and carbon nanotube but that from the standpoint of improving electrical and mechanical properties, the carbon short fiber is more preferably vapor grown carbon fiber with a diameter of 0.05 to 10 μm and a fiber length of 1 to 100 μm. (Ilno, paragraph 30)

Ilno cannot logically be combined with Le Costaouec for a rejection of the claimed invention. Ilno nowhere discloses a nonwoven fiber mat. Additionally, Ilno disclose a carbonaceous filler (component (D)) contained in the electrically conducting curable resin composition. (Ilno, paragraph 30) The carbonaceous fiber of Ilno has no relevance to the **thermoplastic resin fibers** of the claimed invention that form the nonwoven fabric. Therefore, Ilno cannot logically be combined with Le Costaouec to teach the diameter of the thermoplastic fibers of a nonwoven fiber mat.

Le Costaouec teaches away from the claimed invention by requiring the disclosing the carbon fiber orientation in a direction parallel to the thickness of the plate. Further, Le Costaouec and Ilno, alone or in combination, do not teach or disclose the **diameter of the resin fibers**. In fact, Ilno does not disclose thermoplastic resin fibers at all. The cited references, alone or in combination, to not teach or disclose the claimed invention. The Applicant respectfully requests reconsideration of the rejection under 35 U.S.C. 103(a).

The Applicant notes that the related Japanese patent has been registered as Japanese Patent No. 3956956. The Applicant credits the registration to the positive analysis of novelty, inventive step and industrial applicability under PCT rule 43 bis.1(a)(i), issued in the written opinion by the International Searching Authority through the Japanese Patent Office.

Claim 2 is rejected under U.S.C. 103(a) as being unpatentable over Le Costaouec (U.S. Publication No. 2003/0219646 A1) in view of Ilno et al. (U.S. Publication No. 2002/0086198 A1) in view of Kitade et al. (U.S. Publication No. 2003/0129471 A1). (Office Action p. 5)

Kitade discloses a composite material for fuel cell separator molding. (Kitade, Abstract) The Office Action cites to Kitade to compensate for the lack of disclosure in both Le Costaouec and Ilno that the nonwoven fabric has a content of electrically conductive powder of 70 wt% or more. Kitade discloses that the "fixed carbon content is preferably 98% by weight or more, particularly preferably 99% by weight or more." (Kitade, paragraph 29)

The specification of the present invention of the specification discloses the content of the conductive powder in the nonwoven fabric of the claimed invention is preferably 70 wt% or more, and more preferably 80 wt% or more. (Claim 11, Specification, p. 13, l. 12-15) Examples 1 and 3 discloses the use of 80 parts by weight of synthetic graphite as the conductive powder. Example 2 discloses the use of 70 parts by weight of synthetic graphite as the conductive powder. These Examples illustrate that the content of conductive power in the nonwoven fabric of the present invention is much less than that of Kitade.

Additionally, Kitade does not compensate for the lack of disclosure by Le Costaouec and or Ilno of the diameter of the resin fibers as in amended claim 1. The references cannot logically be combined to form the 35 U.S.C. 103(a) rejection for the claimed invention. None of the references, alone or in combination, teach or disclose the diameter of the resin fibers as in the claimed invention. Claim 2 is dependent on claim 1 and thereby incorporates the limitations set forth therein. Applicants respectfully request reconsideration of the rejection under 35 U.S.C. 103(a).

Claim 3 is rejected under U.S.C. 103(a) as being unpatentable over Le Costaouec (U.S. Publication No. 2003/0219646 A1) in view of Ilno et al. (U.S. Publication No. 2002/0086198 A1) in view of Kitade et al. (U.S. Publication No. 2003/0129471 A1). (Office Action p. 5)

Similar to the discussion above, Kitade does not compensate for the lack of disclosure by Le Costaouec and Ilno of the diameter of the resin fibers as in amended claim 1. None of the references, alone or in combination, teach or disclose the diameter of the resin fibers as in the claimed invention. Claim 3 is dependent on claim 1 and thereby incorporates the limitations set forth therein. Applicants respectfully request reconsideration of the rejection under 35 U.S.C. 103(a).

Claim 4 is rejected under U.S.C. 103(a) as being unpatentable over Le Costaouec (U.S. Publication No. 2003/0219646 A1) in view of Ilno et al. (U.S. Publication No. 2002/0086198 A1) in view of Wilde et al. (U.S. Publication No. 2003/0194557 A1). (Office Action p. 7)

Wilde is cited to compensate for the lack of disclosure of porosity of the nonwoven fabric in Le Costaouec and Ilno. Wilde discloses electrode substrates for electro-chemical cells with electrode substrate with a large porosity in excess of 80% or more. (Wilde, paragraph 22) The Office Action states that based on the disclosure of Wilde,

> it would have been obvious to one of ordinary skill in the fuel cell bipolar plate manufacturing art at the time the invention was made to incorporate the separator porosity of Wilde et al., into the bipolar plate fabrication of Le Costaouec as modified by Ilno et al. so that there would be unhindered mass transfer of the filler material without undue lowering of the conductivity.

(Office Action p. 7)

However, the specification of the claimed invention states that the porosity of the nonwoven fabric is preferably 50% or more and 75% or less. (Claim 12; Specification, p. 19, l. 11-21; Examples 1-3). The porosity of Examples 1 and 3 of nonwoven fabric in the claimed invention are 75%. This is in contrast to the porosity disclosed in Wilde of 80% or more.

Wilde does not compensate for the lack of disclosure by Le Costaouec and or Ilno of the diameter of the resin fibers as in amended claim 1. The references cannot logically be combined to form the 35 U.S.C. 103(a) rejection for the claimed invention. None of the references, alone or in combination, teach or disclose the diameter of the resin fibers as in the claimed invention. Claim 4 is dependent on claim 1 and thereby incorporates the limitations set forth therein. Applicants respectfully request reconsideration of the rejection under 35 U.S.C. 103(a).

Claim 5 is rejected under U.S.C. 103(a) as being unpatentable over Le Costaouec (U.S. Publication No. 2003/0219646 A1) in view of Ilno et al. (U.S. Publication No. 2002/0086198 A1) in view of Sakamoto et al. (U.S. Publication No. 2003/0180597 A1). (Office Action p. 7)

The Office Action cites to Sakamoto to compensate for Le Costaouec and Ilno failing to teach or disclose the thermoplastic resin fibers being polyarylene sulfide resin-fibers. (Office Action p. 7-8) While Sakamoto discloses "As the thermoplastic resins, in view of moldability, chemical resistance, durability, mechanical strength, and the like, poly(phenylene sulfide) resins, fluoro carbon resins, and the like are preferable," Sakamoto does not at all disclose resin fibers. (Sakamoto, paragraph 83) Sakamoto mixes liquid or powder resin with graphite particles (see [0088]) with possibly a binder for granulation (see [0091]).

None of the references disclose or suggest a method of entangling thermoplastic resin fibers into a nonwoven fabric. Therefore, the references cannot be combined to teach the elements of the claim 5, which is dependent on claim 1.

Sakamoto does not compensate for the lack of disclosure by Le Costaouec and or Ilno simply by the disclosure of resin. None of the references, alone or in combination, teach or disclose the method of the claimed invention. Further, neither Ilno or Sakamoto disclose a nonwoven fiber mat. Claim 5 is dependent on claim 1 and thereby incorporates the limitations set forth therein. Applicants respectfully request reconsideration of the rejection under 35 U.S.C. 103(a).

Claim 6 is rejected under U.S.C. 103(a) as being unpatentable over Le Costaouec (U.S. Publication No. 2003/0219646 A1). (Office Action p. 9)

The Office Action states that Le Costaouec does not "specifically teach the electrically conductive powder is uniformly distributed within the nonwoven fabric." (Office Action, p. 9) This is in contrast to the claimed invention in which the electrically conductive powder is uniformly distributed within the nonwoven fabric. (Claim 6)

However, the claimed invention is not obvious over Le Costaouec because Le Costaouec does not teach or disclose several elements claimed. Le Costaouec does not teach or disclose the entangling of the thermoplastic resin fibers into a nonwoven fabric of claim 1. Le Costaouec does not teach or disclose the diameter of the resin fibers of claim 1. Claim 6 is dependent on claim 1 and thereby incorporates the limitations set forth therein. Applicants respectfully request reconsideration of the rejection under 35 U.S.C. 103(a).

Claim 9 is rejected under U.S.C. 103(a) as being unpatentable over Le Costaouec (U.S. Publication No. 2003/0219646 A1) in view of Ilno et al. (U.S. Publication No. 2002/0086198 A1) in view of Kitade et al. (U.S. Publication No. 2003/0129471 A1). (Office Action p. 9)

The Office Action states that "Le Costaouec as modified by Ilno et al. and Kitade et al. do not disclose any volume resistivity data. However, it is the position of the Examiner that such properties are inherent." (Office Action, p. 10)

The claimed invention obtains the volume resistivity in the thickness direction of 30 mΩ·cm or less by setting the content of the conductive powder within the range of 70 wt% or more, and more preferably 80 wt% or more. (Claim 11, Specification, p. 13, l. 14-18) The content of the conductive powder of the claimed invention is unlike that that of Kitade which is preferably 98% by weight or more, particularly preferably 99% by weight or more. (Kitade, paragraph 29) The Examples of the present invention use 70 and 80 parts by weight of conductive powder. (Specification, Examples 1, 2, and 3) The content of conductive powder would lead to a different volume resistivity in the present invention from that in Kitade.

Nevertheless, the cited references do not teach or disclose the diameter of the resin fibers as in amended claim 8. As discussed above, Le Costaouec teaches away from the claimed invention by disclosing the carbon fiber orientation in a direction parallel to the thickness of the

plate. Further, Ilno does not teach or disclose a nonwoven fabric and the carbonaceous fiber of Ilno has no relevance to the thermoplastic resin fibers of the claimed invention that form the nonwoven fabric. The references cannot logically be combined to form the 35 U.S.C. 103(a) rejection for the claimed invention. Claim 9 is dependent on claim 8 and thereby incorporates the limitations set forth therein. Applicants respectfully request reconsideration of the rejection under 35 U.S.C. 103(a).

In view of the above amendment, applicant believes the pending application is in condition for allowance.

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Respectfully submitted,

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